State Agency
Annual Energy Usage Report
FY08

Submitted
By:

Final Report with complete FY 08 Utility Data October 3, 2008

Table of Contents

Energy Usage Progress Report

Introduction and Executive Summary

The Department of Commerce, in accordance with A.R.S. §34-451, submits the following report detailing the annual energy savings progress in state buildings. This statute requires three state building systems, the Department of Administration, the Department of Transportation and the Board of Regents, to reduce energy usage in their buildings by 10 percent by July 1, 2008 and 15 percent by July 1, 2011. The baseline year for energy usage per square foot is FY02.

FY04, the first year that this report was required, agencies implemented a considerable number of actions towards meeting the energy saving goals authorized by the legislature. The agency reports showed a **2.5 to 3.0 percent reduction** in energy usage in the first year.

FY05, in the second year of reporting, agencies continued to make strides to reduce energy usage. The Department of Administration (-14%) and the Department of Transportation (-9.9%) report reductions **above or near the mandated 10 percent reduction by 2008.**

FY06, the third year of reporting saw some agencies reaching a plateau, where some of the easy energy saving actions had been exhausted. Compared to year two, year three had 11% more cooling degree days which significantly cut into the previous year's savings.

FY07, in the fourth reporting year, one agency has surpassed the 10% savings goal and others are approaching the goal.

- The Arizona Department of Emergency and Military Affairs (DEMA) has successfully reached the 10% reduction mandate and now stands at 2**2% below** their FY02 level. With cooperation from their Department of Defense partners, DEMA was able to make over $1,000,000 in energy improvements to their facilities to reduce energy usage and to improve the energy security of their facilities. DEMA added 10 kW of photovoltaic panels to increase their system capacity to 50 kW.
- Closing in on the 10% mandate, the University of Arizona (UA) energy usage per square foot of space is **down 9.3%** from the baseline period. Arizona State University (ASU)'s Tempe Campus has **reduced** energy usage **by 7%**. Both universities have completed energy saving performance contracts to improve the efficiencies of all of their facilities on campus.

FY08, on an individual agency basis, the DEMA is the only agency to meet the 10% reduction.

- DEMA has reduced their energy usage by 10.2% below their baseline year usage. With a full time Energy Manager and assistance from their federal military branches, they have achieved remarkable results.
- At ASU's Tempe Campus, energy consumption is down 7.7% from their baseline usage. Their results can be attributed to the completion of Phase 1 of a $35 million Energy Saving Performance Contract. These are very good results when one considers that the Tempe Campus student population increased by 12.1%, 4,999 more students, than during the baseline period.

All agencies made some progress towards reducing their energy usage by 10%; however, there is still quite a ways to go. Examples include:

- Corrections down 6.4%
- ADOT down 6.3%
- ADOA down 2.3%
- DPS down 4.4%
- DES down 1.3%

The most common reason for not meeting the requirement was lack of funding. The Arizona Department of Administration, in consultation with Commerce has completed a bid process that has established a pre-qualified list of Energy Service Companies. By having a pre-qualified list of companies, agencies, universities and community colleges, K-12 schools and local governments will be able to select Energy Service companies to perform energy-saving projects from a statewide contracts list. This streamlining of the process will reduce the time it takes to have an energy performance contract in place and lead to the completion of more energy-saving projects.

Rising Energy Prices

Reducing energy usage is proving to be difficult for other agencies. There are pressures on their utility budget because of utility price increases. The U.S. Commercial Price for natural gas was $6.50 per million Btu in 2002, and reached $14.76 per million Btu in November of 2005. This reporting year, natural gas prices were $11.76 per million Btu in March 2008. This is an 81% increase in price from the baseline year. These high natural gas prices caused a ripple effect in fuel costs to electric companies whose electric generating stations use natural gas. Electric utility companies have had to raise their rates as a result of these increases. With more of the agency's operating and maintenance budgets going to pay higher utility costs, fewer funds are left to make energy improvements.

However, there are new programs that could make it easier for agencies and universities to make energy improvements. In addition to streamlining the Energy Performance Contracting process, the State (Arizona Corporation Commission) has mandated that Arizona Public Service Company (APS) offer a Demand Side Management Program to help their commercial customers make energy efficiency improvements. APS is providing incentives ranging from 10 percent to 50 percent of the cost of an improvement. A large proportion of state facilities are located in APS territory and agencies will be able to take advantage of these incentives. Southwest Gas Corporation also has a Demand Side Management Program.

Department of Commerce Technical Assistance

The Department of Commerce is providing technical assistance to state agencies by conducting energy audits, and providing training opportunities. Commerce has sponsored training sessions on tracking utility bill histories, energy-efficient lighting and motors, compressed air systems and steam systems. Commerce staff has become LEED Accredited, a certification program on designing green features of energy efficiency, renewable energy, water conservation and indoor air quality into buildings. In 2007, staff worked with the Energy Saving Performance Contracting companies to establish an Arizona chapter of the Energy Services Coalition. This national organization has a mission to remove the barriers that stand in the way of governmental entities' use of Energy Saving Performance Contracting. ASU has recently launched a $45 million Energy Performance Contract and the Department of Corrections is finalizing an energy performance contract to make energy and water saving improvements to their Tucson prison complex.

Methodology

Two methodologies were utilized to track compliance. First, the agencies were asked to submit the actions they have taken to reduce energy usage and to estimate the amount of energy saved. The second methodology is to track the progress towards achieving the 10 and 15 percent reduction goals by gathering utility data on their buildings. The methodology is to compare the most recent 12 months of utility bills with the 12-month baseline period of July 1, 2001 – June 30, 2002. A.R.S. §34-451 requires the progress report be submitted by July 1 of each year. Because June utility bills are not available until July, agencies were directed to use the most recent 12 months as the time period for comparison to the baseline period. When May and June utility bills become available,

agencies will submit revisions to Commerce, and a revised report will be submitted to the Legislature by September 1, 2008.

Weather and its Affect on Energy Usage

Unusual weather conditions can affect energy usage and measurement in a number of ways. The most obvious is the affect that higher than normal temperatures have on cooling bills. Unfortunately, most cooling equipment operates less efficiently at higher outdoor temperatures. With higher temperatures more cooling is needed, but at higher temperatures cooling equipment is less efficient. Hence, a 10 percent increase in summer temperature can mean a 15, 20 or even 25 percent increase in cooling energy usage.

Weather conditions are important to this analysis because one of the tasks in determining compliance with the law is to compare the energy usage during the baseline period with the energy usage for the most recent 12-month period. Data from the National Weather Service is used in this report to better understand a variable that contributes to energy usage increases or decreases from year to year.

Weather Conditions for Baseline Year and Current Year FY08

To compare weather conditions from year to year, the common methodology is to review cooling degree days and the heating degree days. Degree days are typically compared to a baseline of 65 degrees. A cooling degree day is calculated by taking the high and low temperature for the day, find the average of the two temperatures and subtract 65 from the average. For example, if we observe a high temperature of 100 degrees and a low of 70 degrees. The average temp is 85 degrees. Now subtract 65 degrees from 85 degrees, and the result is 20 and the cooling degree days for this day are said to be 20. Total cooling degree days are kept by day, month and year for comparisons.

The baseline year of FY02 was one of the hottest years on record. Cooling degree days for FY08 will be 4% less than the baseline year. However, July and August of 2007 were considerably hotter than the corresponding months in the baseline year. And, August 2007 was the hottest August ever recorded in Phoenix.

As another indicator, in baseline FY02, Phoenix had 24 days of 110 degrees or higher temperatures. For the current fiscal year through June 30, 2008, Phoenix has had 36 days of 110 degrees or higher.

On heating degree days, the baseline year had 870 heating degree days. For FY08, there were 958 heating degree days. That is a 10% increase in the number of heating degree days. Meaning that this last winter was cooler than the baseline year and required more heating energy to heat state buildings.

Table #1

Cooling Degree Days – Phoenix				Heating Degree Days - Phoenix		
	FY02	**FY08**			**FY02**	**FY08**
July	920	963		July	0	0
Aug	928	973		Aug	0	0
Sept	823	768		Sept	0	0
Oct	452	419		Oct	0	0
Nov	177	189		Nov	68	30
Dec	0	0		Dec	341	360
Jan	0	0		Jan	272	313
Feb	19	11		Feb	115	201
Mar	89	108		Mar	74	51
Apr	359	227		Apr	0	0
May	525	429		May	0	3
June	858	852		June	0	0
Total	**5,150**	**4,939***		**Total**	**870**	**958**

National Weather Service data through 6/30/08. FY08 had 4% less cooling degree days than baseline year and 10% more heating degree days than baseline year. (FY08 through 6/26/08)

Concluding Comments on Weather

- There were 4% more cooling degree days in the baseline year than the current year.
- The current year had 34 days of 110 degrees or more, compared to 24 days for the baseline year.
    - The result may be that cooling requirements for both years were fairly equal.
- There were 10% more heating degree days in the current year than in the baseline year.
    - Resulting in more energy needed for heating in the current year than in the baseline year.

University Student Population Increases

Although ASU, NAU and UA have taken actions to reduce their energy usage on all campuses, the tremendous increase in the college student population makes it very difficult to compare the energy usage in the university sector over time. The difficulty can be illustrated with the ASU West and Polytechnic campuses. While there has been some square footage of space added to each campus after the baseline period, it was the increase of the student base to the existing buildings – a "filling-out" of the existing campus spaces -- that resulted in large increases in energy usage.

Table #2

Enrollments Fall Semester Full-Time Equivalent						
	ASU Tempe	**ASU West**	**ASU Polytechnic**	**NAU Flagstaff**	**UA Tucson**	**Total**
FY02	41,157	4,387	1,542	17,057	32,460	96,630
FY08	46,156	6,965	4,309	18,281	34,268	109,979
Difference	+4,999	+2,578	+2,767	+1,224	+1,808	13,376
% Increase	+12.1%	+58.8%	+179%	+7.2%	+5.6%	+13.8%

Source: Arizona Board of Regents Fact book – Enrollment History.
This does not include student populations for: ASU Downtown, NAU Yuma or UA South.

Laboratory Facility Additions

Laboratory space uses considerably more energy per square foot than classroom spaces. Laboratories are required to exhaust larger quantities of air to ensure safe working conditions. The equipment in the buildings has higher "plug load" demands. For reporting purposes, the universities have been asked to separate the energy uses of these new lab buildings from the baseline buildings. If the lab building is not separately metered, it may not be possible to list its consumption separately. In this year's report, the UA has new laboratory space that is included in their energy usage numbers. Hence, the UA's Btus/sq.-ft./year numbers for the current year show an increase of usage over the baseline year largely due to the addition of the new laboratory space. In last year's report (FY07) the UA's energy usage was down 9% from the baseline year. The new laboratory has changed the consumption numbers from a 9% reduction in FY07 to a 4% increase in energy usage this year.

Table #3

New Laboratory Space (in Sq.-ft.)*						
	ASU Tempe	**ASU West**	**ASU Polytechnic**	**NAU Flagstaff**	**U of A Tucson**	**Total**
New Laboratory space added since FY02	606,307	94,450	47,324	150,281	593,725	1,492,087

* These numbers presented to show laboratory growth. Not directly used in calculations.

Department of Correction System Prison Population

Arizona's growing population has an unwanted result of more individuals entering the prison system. Corrections has experienced a 13.3% increase in the inmate population since the baseline period. With basically the same square footage of prison facilities, the increases in population causes the energy usage on a per square footage basis to increase.

Table #4	**Department of Correction Managed Facilities – Inmate Population**
FY02	27,451
FY08	31,102
Difference	+3,651
% Increase	+13.3%

(Note: Energy consumption for Corrections is significantly impacted by inmate population. Another way to analyze energy consumption for Corrections is to look at energy usage from a per capita perspective. If one were to look at Corrections according to per capita energy usage as opposed to a per square foot calculation, the energy reduction is larger than reported. For FY02, the energy usage was 35,871,028 Btus per Inmate. In FY08, the energy usage was 30,277,766 per inmate. This calculates to a 15.5% reduction in energy use per inmate.)

Building System Reports

Summary of Building System Reductions

Table #5 contains a summary of the energy usage on a Btus per Square Foot per Year for the three building systems listed in ARS 34-451. It has a comparison between the FY02 information and the preliminary information for FY08. It is noted that the FY08 data is preliminary because the agencies and universities had not received their May and June utility bills before the July 1st reporting deadline. A Final Report will be issued on September 1, 2008.

Department of Administration Building System

The ADOA Building System reports a 5.0% reduction in energy usage in FY08 as compared to FY02. There is a considerable range between agencies. Table #6 contains data on the progress made by individual agency. The DEMA had reduced their usage by 10.2%. Much of this reduction was made possible through their federal military partners who share space with DEMA. The other agency savings range from 1.2% to 6.4%. It has been difficult for the agencies to secure the funding necessary to implement projects larger enough in scope to have a significant impact on reducing energy usage. The recent approval of a pre-qualified list for energy saving performance contracting companies is a major step towards implementing comprehensive energy reduction measures. In addition, APS and the Salt River Project have rebate programs available for energy efficient measures. On the positive side, three new, large buildings on the capitol complex mall have earned the U.S. EPA's Energy Star© labeled building award (ADOA, ADEQ and DHS). These three building are very energy efficient. However, because they are administered by private companies, the utility data for these buildings is not included in Table # 5 or #6 calculations.

Arizona Board of Regents Building System

The Board of Regents results are a 1.3% reduction from the baseline year. A number of factors contribute to the building system not achieving a 10% reduction in energy usage. First, the university campuses have experienced tremendous growth in their student populations since the baseline period. The state system had a 14% increase in students. But on closer review, we see that ASU West and ASU Polytechnic had 59% and 175% increases, respectively. With relatively small increases in square footages on these two campuses, but large increase in student populations, the energy intensity per square footage rose dramatically.

To try and account for the increase in building square footage and the increase in student populations, a calculation can be made to try and factor in these two conditions. In Table #5, the calculation that accounts for the increase in square footage is shown on the second to last line of the table. For FY02, the energy usage for the university system is 130,545 Btus/sq.-ft./year. The energy usage for FY08 was 128,853 Btus/sq.-ft./year. Just as a trend indicator, not necessarily an absolute calculation, we'll divide each of these numbers by their student counts. First, divide 130,545 Btus/sq.-ft./year by 96,630 students in FY02. The result is 1.35 Btus/sq.-ft./year per student. Second, divide 128,853 Btus/sq.-ft./year by 109,979 students in FY08. The result is 1.17 Btus/sq.-ft./year per student. The percentage reduction is 13.3%. This would be an indicator that while square footage and student populations had increased, the energy usage per student is down due to energy efficient actions.

Department of Transportation Building System

ADOT has reduced their consumption by 6.3% from the baseline year. The department has been very active in participating in utility company rebate programs. In the past year, the department has received utility rebates for replacing over 300 old thermostats with new, Energy Star rated programmable thermostats. Each thermostat saves over $100 a year. ADOT has received rebates for replacing inefficient lighting and for replacing inefficient packaged air conditioning units.

Table #5 (FY 08 data)	Baseline Energy Usage 7/1/01 - 6/30/02	Baseline Energy Usage	Baseline Energy Usage	FY08 Energy Usage (Last 12 months)	FY08 Energy Usage (Last 12 months)	FY08 Energy Usage (Last 12 months)
Building System	**Btu/sq.-ft./year**	**Baseline Square footage**	**Total Btus**	**Btu/sq.-ft./year**	**Square footage**	**Total Btus**
Administration (ADOA)	91,904	3,256,653	299,299,437,312	89,760	3,159,603	283,605,965,280
Corrections (FY07)	135,653	7,258,930	984,695,631,290	126,949	7,417,948	942,701,080,652
DEMA	46,100	1,554,000	71,639,400,000	41,400	1,680,103	69,556,264,200
DES	72,392	766,250	55,470,370,000	71,465	766,250	54,760,056,250
Health Services (state hospital)	137,154	378,709	51,941,454,186	139,924	566,874	79,319,277,576
DPS	150,512	388,967	58,544,201,104	143,841	418,653	60,219,466,173
Total ADOA System	639,295	13,603,509	1,530,261,813,892	610,104	14,009,431	1,489,162,110,131
ADOA System Btu/sq.-ft./yr			111,853			106,297
ADOA System Reduction						-5.0%
Total ADOT System	58,816	1,615,466	95,015,248,256	55,088	1,618,491	89,159,432,208
ADOT System Reduction						-6.3%
ASU Tempe Campus	131,084	8,945,779	1,172,648,494,436	120,935	9,620,517	1,163,457,223,395
ASU West Campus	74,246	611,925	45,432,983,550	79,623	736,951	58,678,249,473
ASU Polytechnic	65,333	567,366	37,067,722,878	72,102	865,251	62,386,327,602
NAU	120,870	4,510,390	545,170,839,300	112,615	5,078,823	571,951,652,145
U of A	140,948	10,598,720	1,493,868,386,560	146,483	13,841,317	2,027,517,638,111
Total University System		25,234,180	3,294,188,426,724		30,142,859	3,883,991,090,726
Baseline Total Btus/sq.-ft./year			130,545			128,853
University System Reduction						-1.3%

Agency Reports

Agency Summary Table

Table #6 Preliminary Data Building System	Energy Usage Baseline 7/1/01 - 6/30/02 Btu/sq.-ft./year	2008 Target 10% Reduction Btu/sq.-ft./year	2011 Target 15% Reduction Btu/sq.-ft./year	Energy Usage FY08 Estimate Btu/sq.-ft./year	Percent Change FY08 from Baseline
Administration (ADOA)	91,904	82,714	62,249	89,760	-2.3%
Corrections (DOC)	135,653	122,087	115,305	126,949	-6.4%
DEMA	46,100	41,490	39,185	41,400	-10.2%
DES	72,392	65,153	61,533	71,465	-1.3%
Health Services State Hospital	137,154	123,439	116,581	139,924	+2.0%
DPS	150,512	135,461	127,935	143,841	-4.4%
ADOT	58,816	52,934	49,993	55,088	-6.3%
ASU Tempe Campus*	131,084	117,976	111,421	120,935	-7.7%
ASU West Campus**	74,246	66,821	63,109	79,623	+7.2%
ASU Polytechnic***	65,333	58,800	55,533	72,102	+10.4%
NAU	120,870	108,783	102,740	112,615	-6.8%
U of A****	140,948	126,853	119,806	146,483	+3.9%

* ASU Tempe Campus added 606,307 sq.-ft. of laboratory space after the baseline period. This space is sub-metered and is not included in this calculation. Laboratories use considerably more energy per square foot of space. Including their consumption would skew the data.

** ASU West Campus had 4,387 students in FY02 and 6,965 in FY08, a 58% increase. (Full Time Equivalent)

*** ASU Polytechnic had 1,542 students in FY02 and 4,309 in FY08, a 179% increase. (Full Time Equivalent)

**** The University of Arizona added 593,725 square feet of space in the past year, including high usage laboratory facilities. Laboratories use considerably more energy per square foot of space. The U of A is including their lab consumption in their reporting numbers.

Agency Reports

Arizona Department of Administration (ADOA)

ADOA building system has two major categories:

1. Buildings managed by ADOA for other agencies.
2. Buildings managed by the other agencies.

In addition to the building space ADOA manages for their employees, ADOA manages additional space for their agency tenants including the Departments of Agriculture, Attorney General, Commerce, Corporation Commission, Corrections, DES, Education, Health Services, Juvenile Corrections, Land, Revenue, Supreme Court, and many Boards and Commissions. Energy usage for FY08 was 2.3% less than the baseline year. ADOA also began an active program to install energy efficient measures in their buildings and use the APS incentive program called Solutions for Business.

Actions Taken in FY08	Project Cost	Estimate Annual Savings*
Completed a cooling tower upgrade project for Courts Bldg. The energy portion of the project installed variable frequency drives, re-built 3 pumps and added new fill material for the tower.	$154,364	$40,088
Lighting upgrade project for Courts Bldg.	$142,365	$69,341
Heat Pump replacement project for Mines and Minerals Bldg. Replaced old, failed units with new, efficient units.	$22,500	$5,115
Gas water heater replacement in two buildings. (100 gallon units)	$14,724	$7,090
Elevator system controls and motor modernization project at DES West bldg. Energy benefits include new digital controls to reduce elevator run times, more efficient variable voltage variable frequency drives and more efficient generator drive sets.	$932,422	$7,036
Water source heat pump replacement at Attorney General bldg. (15 South 15th Ave.) (Three 3.5 ton units)	$6,273	$1,727
Totals	**$1,272,649**	**$130,397**

* Estimated Savings are for a full year. The projects were installed throughout the course of FY08. Estimated savings for FY08 were $61,624.

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ADOA managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
ADOA	91,904	82,714	78,118	89,760	-2.33%

Arizona Department of Corrections

The Department submitted a 30-page report containing the utility bill histories for their 11 prison complexes. The report covers their 1,436 buildings containing 7,417,948 sq.-ft. of space. Data for the most recent year when compared to the baseline year shows natural gas consumption down 5%. Propane consumption is down 25%. Electricity is down by 3.3%. Combining these numbers, Correction's energy usage is down 6.4%. In contrast to other state agencies, the Department's facilities operate 24/7. The result is night and weekend consumption is a greater factor in overall energy consumption than for other state agencies. Their inmate population has grown by 13% since the baseline period. The department has designated an Energy Manager to track utility costs and implement programs and processes to reduce energy consumption. Each prison complex has an Energy Coordinator to lead energy conservation efforts. The Department is entering into an Energy Savings Performance Contract at the Tucson complex. It will be the model to expand to other campuses. Below is an example of the actions taken to reduce energy usage at the Florence complex. A copy of their report is on file with Commerce. A partial list follows.

Arizona Department of Corrections – Actions Taken*

Actions Taken in FY08*	Project Cost	Quantities
Convert light fixtures to energy-efficient lighting	$18,425	90
Install photocells on security lighting	$1,400	87
Install programmable thermostats, occupancy sensors and timers.	$777	37
Install water saving devices	$2,422	226
Install energy efficient water heaters	$10,100	14
Totals	**$33,125**	

* At the submittal deadline, Corrections had only gathered energy actions data for the Florence complex. Data for the other prison sites is being collected and will be submitted for September Final Report.

Arizona Department of Corrections

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
Corrections	135,653	122,087	115,305	126,949	-6.4%

Arizona Department of Economic Security (DES)

DES FY08 electric consumption decreased 1.3% from our FY02 baseline. A 10% reduction was targeted for FY08 as required by ARS 34-451. DES reports the FY08 goal was not met because DES did not receive funding for equipment replacement to affect energy usage in state owned buildings.

DES has been able to make small reductions in electricity usage by installing more efficient HVAC and lighting systems when existing systems reached the end of their useful life. DES reports that significant changes in the efficiency of DES buildings has not occurred due to the lack of capital funding to install more efficient systems (lighting and AC) in DES buildings. Since the consumption is measured in BTU per square feet, and many FTE changes have happened since FY02, it's hard to quantify the impact that staff changes have had on energy usage. Weather does not appear to have played a role in DES' electric usage.

DES has explored the option of contracting for the replacement of inefficient systems and paying for the replacement through future utility savings but has found the financing impractical at this time.

Actions Taken in FY08	Project Cost	Estimated Annual Savings
Two HVAC units replaced at the AIB facility located 3013 W. Lincoln, Phoenix, Arizona.	$7,600	$665
Five HVAC units replaced at the ATP facility located in Coolidge, Arizona.	$21,266	$3,560
Totals	**$28,266**	**$4,225**

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
DES managed Buildings	**Btu/sq.-ft./year**	**Btu/sq.-ft./year**	**Btu/sq.-ft./year**	**Btu/sq.-ft./year**	
	72,392	65,153	61,533	71,465	-1.3%

Arizona Department of Emergency and Military Affairs (DEMA)

DEMA has reduced their energy consumption from 46,100 Btu/sq-ft in FY02 to 41,400 Btu/sq.-ft. in FY08. This is a 10.2% reduction. The sharing of facilities with federal entities has allowed DEMA to use programs available from the federal government. DEMA is currently demonstrating solar photovoltaic systems, wind energy systems and solar thermal cooling systems at their facilities.

Actions Taken in FY08	Project Cost	Estimated Annual Savings
On-going bldg energy audits of all energy using equipment, including the verification of lighting levels: reduced as applicable to OSHA requirements (not to affect security or productivity or safety of employees.) Audits of approx. 10% of DEMA buildings are completed every FY. *	In-house staff – zero cost	$10,000
Continued awareness campaign to get employee involvement (adopting the Governor's Smart Energy Usage Plan). Employees shutting off unneeded lighting and/or office equipment. Program has been expanded by the environmental office, setting up an EMS committee to establish regular site visits and occupant training/ awareness. **	In-house staff – zero cost	$6,000
Continue to raise temperatures to 76-77 degrees in summer months, and lower to 70-71 degrees in winter. (Adjusted/ controlled 24/7 in 33 buildings by BACnet EMCS.)	In-house staff – zero cost	$10,000
Completed retro-commissioning HVAC system and central plant for the HQ Facility. Includes a reconfiguration of piping and automated valves in central plant.	$34,000	$6,000
Integration of BACnet EMCS with occupancy sensors to setback cooling/ heating when rooms show no occupancy after 1 hour. (Several buildings at PPMR currently completed: just beginning to install units at WAATS training site (mostly targeting classrooms).	$6,000	$1,200
Retro-commissioning at Bellemont Readiness Center. (Contract and in-house staff).	$10,500	$1,500
10 KW photovoltaic arrays operating at Valencia (Bushmaster) Armory in Tucson (partnership with TEP). Building supports border mission (secondary command center location).	$	$2,500
Added 10 KW to existing 40 KW photovoltaic arrays at WAATS (e.g.: WAATS Solar Farm). Array is now 50 KW. (Building base load is 90KW - plans to grow farm to 90KW by 2010).	$74,000	$22,000
Continuous-commissioning of WAATS (L4500) Administration Facility; On-going central plant DDC control renovations. (Adjustments to sequence of operations).	$12,000	$24,000

DEMA – Continued Actions Taken in FY08	Project Cost	Estimated Annual Savings
Solar absorption chiller project at PPMR on the DEMA ECO-building. Using solar thermal cooling to cool the ECO-building and almost 1/2 of the Facilities Management Administrative Facility. Partnership with Salt River Project as a demonstration of the new technology. Estimated to provide over 120,000 Btus/hr of cooling from a solar thermal array of heat pipe vacuum tube solar collectors.	SRP has not released final costs (private study being done in progress).	$1,200
Completed super T8 lighting replacement at PPMR USPFO Administrative Facility (in lieu of scheduled group re-lamp project). 32W T8 lamps and ballasts replaced with 28W super T8s with new ballasts.	$1,400	$900
Totals	**$137,900**	**$85,300**

- * On-going building energy audits include adjusting settings of ALL equipment (temperature settings, occupancy sensors, photocells, etc)
- ** DEMA has seen a noticeable increase in the number of employees who are actively participating in DEMA's energy program.
- *** Many DEMA buildings are now operating 16-24 hours per day, with a considerable increase in the number of occupants, due to border security and for continuing support of the mission in the Middle East (computers, admin/training classes and billeting for soldiers and support staff).

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
DEMA	46,100	41,490	39,185	41,400	-10.2%

Arizona Department of Health Services (DHS)

- The State Hospital worked with the ADOA to complete the following project. ADOA was the project manager.

Actions Taken in FY08	Project Cost	Estimated Annual Savings
Replaced old parts in the cooling towers, Chiller 1. New fill provided.	$24,845	$2,300
Totals	**$24,845**	**$2,300**

At the Department's new office building at 150 N. 18th Ave., a number of actions were taken to reduce energy usage. These actions resulted in the Department receiving the U.S. EPA's Energy Star Building label. It became the third state agency building to receive the award. This building is managed and administered by a private company and therefore, the energy consumption of this building ***is not*** included in the calculations in this report. The department also has considerable office space in 1740 W. Adams. This building is administered by ADOA and the energy data is included in ADOA's report, not in DHS's report.

Arizona Department of Health Services (DHS)

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
DHS	137,154	123,439	116,581	139,924	+2.0%

Arizona Department of Public Safety (DPS)

DPS has implemented of numerous energy conservation measures with the net result being only a modest reduction in usage. Despite aging buildings and an exponential increase in use of electronic devices such as computers, printers, consoles, microwave processors, communications, security equipment, DPS has achieved some reduction in usage. An increase in hours of operation and a significant increase in staff have occurred within existing building square footages.

Actions Taken in FY08	Project Cost	Estimated Annual Savings
Raise temperature one-to-two degrees statewide during the summer.	$0	$7,000
Add white coating during re-roof process.	$20,000	$3,727
Replace older modular buildings slated for surplus, with newer, higher efficiency units.	$10,000	$450
Through attrition and remodel, replaced approximately 500 T12 lamps with more efficient T8 lamps.	$6,500	$1,248
Replaced six incandescent exit signs with LED.	$180	$132
Replaced older A/C units for newer, higher efficiency models (six locations).	$38,326	$5,755
Totals	**$75,006**	**$18,312**

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage	Percent Change from Baseline
Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
DPS	150,512	135,461	127,935	143,841	-4.4%

Arizona Department of Transportation (ADOT)

For the baseline year of FY02, ADOT collected utility bill history for their 91 largest buildings and determined energy usage on a square foot basis. Since that time, ADOT has discontinued use of 4 buildings and replaced 2 buildings for a total of 89 buildings. These changes necessitated a change in the original baseline. This year's report has ADOT's building energy usage 4.6% lower than the baseline in FY02. (ADOT submitted a very detailed list of actions taken, below is a summary of that list. ADOT's full report is on file with Commerce.)

Actions Taken FY08	Quantity of the Action	Estimated Annual Savings
Lighting measures: Convert T12 lamps to T8 lamps, install compact fluorescent lamps	83	$11,789
Replace old exit signs with LED exit signs.	15	$426
Replaced old thermostats with Energy Star© rated programmable thermostats	313	$31,300
Replaced inefficient heating and cooling packaged unit with energy-efficient package units	29	$7,612
Replaced old roofs or applied new white reflective roof membranes	4	$2,500
Replaced 40 and 30 gallon water heaters with smaller and more efficient units.	16	$2,020
Replaced old windows with Energy Star©-rated windows units.	3	$225
Total Annual Estimated Savings		**$55,872**

Arizona Department of Transportation (ADOT)

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
Building System	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
FY08 89 buildings	58,816	52,934	49,993	55,088	-6.34%

The data submitted by ADOT is very comprehensive.

* **The following locations were removed from the baseline because operations moved to buildings not in baseline and contributed to the change in values.**

1. May and June 2008 data updated.
2. FY08 - 2225 S. 22nd Ave added to replace Tri-City Field (2128 E. Rio Salado)
3. FY08 - 3540 E. Andy Devine added to replace Red Mountain Modular (1435 S. Price)
4. FY08-Square footage and building description corrected for Tempe Enforcement (2500 W. Broadway) from 2,854 to 4,225sf. As it was discovered meter fed vehicle inspection area.
5. FY08- Square footage corrected for Black Canyon Construction Office (2501 W. Georgia Ave.) from 6,323 to 9,348sf.
6. Cooling degree days were slightly less than the baseline year, however, heating degree days increased by 10% over baseline year. ADOT achieved a 6.34% reduction in energy usage per sq.-ft. Had the heating and cooling degree days total remained equal to the baseline, the projected change would have been more than the 6.34% energy savings reduction.

The Arizona Board of Regents (ABOR)

Arizona State University Tempe Campus

An Energy Saving Performance Contract provides ongoing energy conservation through the improved performance of thermal systems and buildings. All new campus buildings are being designed to ensure energy efficient performance; Biodesign Building B has been awarded LEED Platinum certification. Biodesign Building A, and Interdisciplinary Science and Technology Building, have been awarded LEED Gold certification, while Interdisciplinary Science and Technology Building 2 was recognized with LEED Silver certification.

Actions Taken FY08	Project Costs	Estimated Annual Savings
Utilization of performance contract operations	$34,000,000	$3,834,000
Lighting: re-lamped 12 buildings, from T8-32w to T8-25w	$435,907	$35,000
Test Application at Biodesign Building B of demand ventilation for use in all laboratories	$50,000	$75,000
Optimized utilities dispatch for cross-connected steam between plants	None	$14,520
Life Sciences E wing: Retro-fit HVAC controls & rebalance for lower air changes.	$551,400	$283,000
Global Institute of Sustainability building: Wind Turbine installation.	$48,500	*
Total		**$4,241,250**

* Expected annual savings $1,200 for 6 kW of turbine capacity.

Arizona State University Tempe Campus

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ASU Tempe Campus	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
ASU Tempe	131,084	117,976	111,421	120,935**	-7.7%

** Excludes new research laboratory space added since the baseline, of 606,307 sq. ft. that consumed 317,144 MMBTU. Laboratories use considerable more energy than classroom or office buildings. Adding the laboratories to the baseline would skew the numbers and hide any savings. Includes: Biodesign A & B, Interdisciplinary Science and Tech 1 & 2, and Research Support Services 5.

ASU West Campus

- Since the baseline year of FY02, the student population in Full Time Equivalent (FTE) has increased 58% from 4,387 to 6,965 students in the spring of 2008.
- The campus is becoming a more full service campus. A new laboratory building opened in January of 2004, increasing the total square footage by 12.32%. This facility operates 8,760 hours per year compared with other facilities that operate at a minimum of 50% less hours.
- In June of 2005, operating hours were changed on the original Classroom Laboratory Building from 4,234 hours per year to 8,760 hours per year. With these two facilities, the total square footage operating is at 8,760 hours per year. This increase in operating hours has added an estimated increase of 2,013,300 kWh per year at the buildings and central plant. This additional usage costs $134,764 per year. There has been an increase in Btus per square foot.
- Site lighting to all parking lights are powered from the existing building systems, which has been part of the Btus per square footage calculation. Additionally, in 2005 a new parking lot with site lighting was added, which is powered from existing buildings. Actual cost and usage has yet to be determined.
- All boiler controls have been programmed to compare outside air conditions along with indoor conditions to reduce operational hours by 25% in all buildings with boilers.
- Since the baseline year of FY02, ASU West has increased the number of hours for classroom utilization from the typical Monday – Thursday operation. Now there are classes Monday – Friday and additional classes on Saturday each week. The additional load has been trimmed though effective upgrades of the campus wide controls, which has provided for a more precise control of all buildings.

Actions Taken FY08	Project Costs	Estimated Annual Savings
Programming to reset the chill water flow during cold or mild weather. Result: 35% reduction in VFD speed at these off times.	In-house staff	$1,100
SANDS- Building controls allow a later start time to cool the building. Boiler Start/Stop controls are reset from outside air temperature to only run when needed at least a 50% reduction in run time. VAV fans are cycled off during unoccupied times. Outside air damper is modulated by CO2 monitor in return air.(Allows the minimum 20% return air for the majority of the time for maximum energy savings during the warmer season)	$1,200	Not Determined
FAB- Limit VFD for AHU 12 (Electrical Vault) to 32% max frequency output during satisfied conditions. Reset the room set point to 75 degrees at all times. Also shut down the AHU for 5 hours every night with a safety band to start the AHU if the temp rises above set point. 5 X 365 = 1825 hours reduction per year.	In-house staff	$4,240
UCB- Full DDC control of the La Sala area to reduce the cool down startup. Programming has changed the startup sequence of the AHU and reduced the cool down time from 3 hours to 20 minutes. Reducing run time by 780 hours per year	$35,610	$6,200
ASU West Campus - Continued		

Installed new DDC Control to all FAB mixing boxes and removed (4) control air compressor. Reduced campus on peak demand by 4.18% through load shedding using EMS upgrades. Reduced total campus electrical usage by 1.98% with EMS upgrades.	$354,954	$56,500
Total	**$391,764**	**$68,040**

ABOR managed buildings	**Baseline Energy Usage 7/1/01 - 6/30/02**	**2008 Target 10% Reduction**	**2011 Target 15% Reduction**	**Energy Usage (Last 12 months)**	**Percent Change from Baseline**
ASU West buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
Electricity	66,817	60,035	56,795	71,042	6.32%
Natural Gas	7,429	6,686	6,314	8,581	+15.50%
Total	**74,246**	**66,821**	**63,109**	**79,623**	**+7.2%**

ASU Polytechnic Campus

Through an energy saving performance contract, ASU at the Polytechnic campus has been actively monitoring the performance to several of their buildings. Currently the Polytechnic campus is in its fifth year of the performance contract. To enlist the support of staff and students, the Energy Conservation Committee has a campus-wide awareness campaign that includes a website, an energy hotline and articles placed in campus newsletters. Three new building complexes were designed and built to Silver LEED certified standards, these buildings will be in next years report due to certificate of occupancy being granted on July 1, 2008.

The Polytechnic campus is in a growth state and the energy usage will vary until it establishes its consistent baseline of student population. In FY02 the student population was 1,542 with 567,366 of operating square footage. For FY08 the Polytechnic campus has a student population of 4,309 with 865,251 of operating square footage. The student population is up 179% over the baseline year. With the introduction of several new facilities the campus has experienced longer hours of operations due to additional course offerings based on student demand. Along with this growth the Polytechnic campus added a new aviation hanger, research and academic support facilities, and the former Air Force base K-12 school campus comprised of ten buildings.

ASU Polytechnic - continued

Actions Taken FY08	Estimated Project Cost	Estimated Annual Savings
Monitoring savings of performance contracting measures of lighting retrofits, HVAC equipment and chiller replacement.	$2,500,000	$172,971
Energy reduction mandated by ASU administration (Cooling set point 78 degrees, heating set point 68 degrees	minimal	$139,017
Strategic changes to utility bill rate schedule	Staff labor	$49,714
Total	**$**	**$361,702**

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
ABOR managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
ASU Polytechnic	65,333	58,800	55,533	72,102	+10.4%

Northern Arizona University (NAU)

During FY08, three projects on the mountain campus were certified by the U. S. Green Building Council (USGBC) under the green building rating system called "LEED." The Franke College of Business Administration and the College of Engineering and Natural Sciences Buildings were certified as LEED Gold. The Applied Research and Development Building was certified as LEED Platinum, the highest certification offered by the USGBC.

Additional construction on the campus has aided conservation efforts by implementing LEED practices. A new campus residence hall, Aspen Crossing, the Dining Expansion at the University Union, and the High Country Conference Center have been LEED inspired. Additionally, Drury Hotel, constructed by Drury Southwest is seeking LEED Certification. This hotel facility will not be part of the campus energy footprint but the commitment to the LEED construction program was an integral component of the overall campus construction plan.

This year, some of the conservation efforts on the campus were:

1. Implemented campus wide use of the "sleep" function on campus computer equipment.
2. The first phase of implementation for the Vending Miser system has been completed and shall be concluded when the final deliveries of the new vendor equipment components are installed. This device allows the vending machine to enter a lower level of operation when there is no one present to use the machine.
3. Higher efficiency windows were installed in 7 residence halls, replacing glazing technology dating back to the 1960's.

	Baseline Energy Usage 7/1/01 - 6/30/02	**2008 Target 10% Reduction**	**2011 Target 15% Reduction**	**Energy Usage (Last 12 months)**	**Percent Change from Baseline**
ABOR managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
NAU	120,870	108,783	102,740	112,615	-6.8%

University of Arizona

As FY08 rolls to a close, the UA has implemented strategies to reduce and conserve energy usage and costs. As noted in the data below, the number, size and effects of the implemented projects provides knowledgeable indicators of the UA's commitment to energy and cost savings for its customers, the community and the State. The University diligently strives to exceed the ten and fifteen percent mandatory reductions.

	Actions Taken	Project Costs	Estimated Annual Savings
1	Alumni added to the UA chilled water and electric grid.	$275,000	$107,523 for the first year in first time cost avoidance and energy savings. $8,723 savings each year.
2	Real Estate Administration added to the UA grid	na	$6,975/year
3	Added 49 Calmac tanks at Chiller Plant to add 7,350-ton hours on the UA grid to accommodate the additional load for the University Medical Center bed tower. Tanks installed instead of adding a water chiller in order to use the nighttime efficiency instead of daytime peak load.	$1,288,000	One time savings of $420,000 for the purchase of ice chiller instead of water chiller. $140,851 per year operations savings with ice vs. water chiller
4	Upgraded the UMCC NEP chilled water pipe to eliminate the two 10 inch bottlenecks in the north tunnel at AHSC.	$50,000	$25,146 savings per year based on a 2 psi reduction to the entire chilled water system
5	Ongoing campus wide Facilities Management Plumbing Shop Steam Trap Repair/Replacement Program.	$11,024	Est. Annual Savings $416,000
6	Building Energy Management System occupied/unoccupied modes were established for 4 large campus building HVAC systems, allowing for an increase in building climatic conditions resulting in significant utility savings during unoccupied hours.	$850	Est. Annual Reduction in Energy Usage in Excess of 20%
7	Heating hot water and domestic hot water systems were completely refurbished and re-commissioned in 5 campus buildings.	$162,691	Average Annual Reduction in Energy Usage & Increased System Efficiency 15-20% per Building
8	The campus wide Air Handler Scheduling Program was greatly expanded during FY08.	$14,640	Est. Annual Savings $949,774
9	Conceptual design development for harvesting of air handler condensate at the new MRB and Bio 5 Buildings, to be utilized for boiler makeup at the campus Central Heating & Refrigeration Plants, while also eliminating current	$33,618	Combined Est. Annual Savings $6,086

	landscape damage around the buildings.		
10	A "Smart Classroom" Energy Program was developed and implemented during FY08, consisting of a conversion to DDC controlled terminal units utilizing infrared/ultrasonic motion detectors, allowing for occupied/standby/unoccupied temperature set points for maximum energy conservation. This concept creates a totally automatic switch from unoccupied to occupied or standby modes, without the need for manual override or reprogramming of scheduling parameters related to classroom occupancy.	$800 - $8,000 Per Room Depending on Existing Classroom HVAC conditions.	Est. Annual Utility Reduction in Individual Classroom Energy Usage Related to HVAC 50-75%
11	Remote reprogramming of over 500 digitally controlled thermostats for summertime set points of 76 degrees. All digital room temperature controls at the Main Library have similar energy friendly set points which have been pre-set from our remote workstation facility, disabling all local control.	$488	Est. Annual Reduction in Energy Usage in Excess of 20%
12	Complete redesign and replacement of aging filter & backwash system at the Student Recreation Center Swimming Facility.	$142,676	Est. Annual Utility Cost Savings 15%
13	Shutdown of Building HVAC Systems and Outlying Properties during Campus Holiday Shutdown, FY08.	$4,880	$128,316
	Totals	**$1,983,867**	**$1,673,148**

University of Arizona (UA)

	Baseline Energy Usage 7/1/01 - 6/30/02	2008 Target 10% Reduction	2011 Target 15% Reduction	Energy Usage (Last 12 months)	Percent Change from Baseline
U of A managed buildings	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	Btu/sq.-ft./year	
U of Arizona	140,948	126,853	119,806	146,483	+3.9

In FY08, additional square footage included the Cherry Ave. Garage addition placed on the campus electrical grid. The Alumni and the Poetry Center were added to the U of A chilled water grid with an additional 59,017 square feet of space.

Appendices

Copy of A.R.S. §34-451

34-451. Energy conservation standards for public buildings

A. The department of commerce in consultation with persons responsible for building systems shall adopt and publish energy conservation standards for construction of all new capital projects as defined in section 41-790, including buildings designed and constructed by school districts, community college districts and universities. These standards shall be consistent with the recommended energy conservation standards of the American society of heating, refrigerating and air conditioning engineers and the international energy conservation code.

B. The standards shall be adopted to achieve energy conservation and shall allow for design flexibility.

C. The following state agencies shall reduce energy use in public buildings that they administer by ten per cent per square foot of floor area on or before July 1, 2008 and by fifteen per cent per square foot of floor area on or before July 1, 2011, using July 1, 2001 through June 30, 2002 as the baseline year:

1. The department of administration for its building systems.

2. The Arizona board of regents for its building systems.

3. The department of transportation for its building systems.

D. The state energy office shall provide technical assistance to the state agencies prescribed in subsection C of this section. On or before July 1 of each year, the state energy office shall measure compliance with subsection C of this section, compile the results of that monitoring and report to the speaker of the house of representatives and the president of the senate as to the progress of attaining the goals prescribed in subsection C of this section. The state energy office shall include in its report an explanation of the reasons for any failure to achieve energy reductions in specific building systems as prescribed in subsection C of this section.

E. All state agencies shall procure energy efficient products that are certified by the United States department of energy or the United States environmental protection agency as energy star or that is certified under the federal energy management program in all categories that are available unless the products are shown not to be cost-effective on a life cycle cost basis.